Measurement and Modeling of Pollutant Inputs to San Diego Bay from the Chollas Creek Watershed

BACKGROUND

The flows and pollutant loading to San Diego Bay from Chollas Creek are a reflection of its watershed characteristics. Chollas Creek is an arid urbanized watershed, which translates into a very "flashy" hydrologic system with numerous potential sources of pollutants. While there is almost no flow during completely dry periods, flows during rainfall events are dramatic. Peak flows of 10,000 cfs have been measured within two hours after the onset of rainfall as a result of the high proportion of imperviousness within the drainage area.

Pollutants generated from urban activities within the watershed are mobilized and transported during storm events and have resulted in impacts to receiving waters. Monitoring of Chollas Creek's north fork has shown that stormwater discharges are toxic to both freshwater and marine organisms. The toxicant responsible for these effects has been identified as organophosphorus pesticides (most likely diazinon) and trace metals (most likely zinc and copper). Both of these constituents exceeded water quality thresholds in runoff samples and were confirmed through a toxicity identification evaluation (TIE). In addition, sediments measured at the mouth of Chollas Creek, where it enters San Diego Bay, has elevated levels of these constituents as well as other potential toxicants (i.e. chlorinated hydrocarbons such as chlordane, total DDT, etc.). These impacts to sediments have, in turn, impacted infaunal communities.

As a result of the effects measured in stormwater discharges and at the mouth of the creek in San Diego Bay, Chollas Creek has been added to the State's list of impaired waterbodies (§303d list). Once on the §303d list, Chollas Creek is now subject to a Total Maximum Daily Load (TMDL). TMDLs are designed to reduce inputs to impaired waterbodies and, ultimately, to restore beneficial uses. A TMDL has recently been drafted for diazinon in the Chollas Creek watershed. However, no TMDL has yet been written for trace metals in Chollas Creek. This is because some of the elements necessary for a trace metal TMDL are not yet known. These elements include source identification, linkage analysis, a margin of safety, and an implementation plan.

The goal of this project is to begin addressing some of the missing elements for the Chollas Creek trace metal TMDL. This will be accomplished by developing a dynamic model of the Chollas Creek watershed. This will assist in source identification because modeling can isolate certain land uses, subwatersheds, or reaches of the watershed to ascertain where disproportionate loadings are being generated. The model will also assist in linkage analysis since it inherently transports metals from their sources within the watershed to the mouth of channel enabling estimates of total loading, as well as concentrations from cumulative discharges. The model can be used to generate a variety of margin of safety (MOS) scenarios, based on variability in flow, concentrations, or loading. Finally, the model can be used to examine a wide array of potential management actions suitable for implementation planning.

SCOPE OF WORK

This project is comprised of four tasks. The first task will collate and evaluate historical data. The second task will generate new data, as necessary, to develop the model. The third task will include model development such as calibration and validation. The fourth task will include reporting.

Task 1. Historical data

The goal of this task is to collate and evaluate historical data in the Chollas Creek watershed. This data will be divided into three components. The first component is physical data. Physical data, such as watershed and subwatershed delineations, channel cross section, channel substrate and slope, storm sewer profiles, etc. needs to be collected in order to appropriately route flows.   The second data type is hydrology data. Hydrology includes flow and rainfall. Since rainfall is the forcing function in the model, this is an important item. The third data type is water quality data. The co-permittees have been monitoring the north fork of Chollas Creek since the 1993-94 water year. We will determine if the water quality measurements they have made are amenable to modeling.

Task 2. Collect New Data

The goal of collecting new data is to support model development and to evaluate stormwater loading relative to other potential sources of trace metals to San Diego Bay near Chollas Creek. Although the data compilation from task 1 will help to identify specific data gaps, it is anticipated that two types of data will be needed at a minimum. The first type of data that will need to be collected is flow data. There is no gaging station that currently exists on Chollas Creek and flow data is paramount to successful calibration and validation of the hydrologic model. The second type of data collection is for atmospheric deposition of trace metals. Both direct and indirect atmospheric deposition information is needed. Direct deposition will be used to estimate loading to the creek surface and San Diego Bay, particularly near the mouth of the creek where there are numerous potential sources to the air. Indirect deposition will be used to estimate the loading to the watershed that could get transported to the creek and watershed during rain events.

Task 3. Model Development

This task will entail the final configuration, calibration, and validation of a dynamic water quality model for the Chollas Creek watershed. It will be based on the data collated in Task 1 and collected as Task 2. Model output would include annual loading by land use and pre-defined subwatersheds. Model output would also include concentration on a storm-by-storm basis in hourly averaged intervals. Sensitivity analysis to water quality and hydrologic parameters will be conducted to assess an implicit MOS. At least three model runs will be dedicated to implementation plan. Management action reduction efficiencies should be provided by either the regulatory, regulated, or environmental community.

Task 4. Draft and Final Report

A draft will be written at the conclusion of Task 3. The report will include an introduction that frames the problem, a methods section that will describe the approach and specific methodologies used to build the model (including modeling assumptions), a results section that describes the modeling output (including sensitivity analysis), and a discussion section that frames the limitations of the work provided. The draft report will be given to the RWQCB and any designee thereof, for review. A final report will be written based on comments from the RWQCB review.

SCHEDULE (assumes a Jan 1, 2004 start date)

Task	**Completion Date**
Task 1. Historical Data	Mar 31, 2004
Task 2. Data Collection	April 15, 2005
Task 3. Modeling	Aug 30, 2005
Task 4. Reporting	December 31, 2005

BUDGET

Task	**Cost**
Task 1. Historical Data	15,000
Task 2. Data Collection	155,000
Task 3. Modeling	60,000
Task 4. Reporting	30,000
TOTAL	$260,000